

WIRELESS SIGNAL TRANSMITTING AND RECEIVING SYSTEM

BACKGROUND OF THE INVENTION

Field of Invention

The invention relates to transmit video and audio signals in multiple analog and digital
5 formats wirelessly by optical means with provisions to counter signal interruptions and
provide easy optical alignment.

Related Art

With the advent of High Definition Television (HDTV) and increasing use of high
resolution color graphics and "streaming video" in computer display data, there has
10 emerged a need to transport large amounts of data at high speed from a variety of source
devices to display devices. The traditional means of this transmission has been use of
"video-grade" single conductor or twisted pair wires, but with data rates approaching or
exceeding 1Gb/s, transporting signals without errors or severe distortion is difficult.
Particularly in the case of HDTV's where marketing research has lead to devices which are
15 intended to bear a resemblance to large hanging paintings, there is a strong desire to keep
the numbers of visible signal wires to a minimum for aesthetic reasons.

The traditional means of wireless video/graphics transmission has been to use a
modulated Radio-Frequency (RF) signal, but current national and international frequency
allocations for other than Television channels restricts transmission to frequency bands
20 which will not support the information bandwidth needed for "real-time" video/graphics.
To overcome this limitation, information compression techniques such as those
standardized in the MPEG series must be used, which leads to some degradation in the
picture quality as a reduction of as much as 1/200 times of the original information content.
Nevertheless, the availability of MPEG compression electronics and the ease of set-up and
25 use of RF wireless units have resulted in the commercialization of these devices at the
expense of picture quality and/or transmission speed.

To attempt to deliver high resolution video/graphics without the losses associated with information compression, optical wireless units have been designed to transport video and graphics. However, these devices have relied on optical beams which are susceptible to be blocked by the passage of the human body between the transmitter and receiver. Also, they
5 have used automatic beam aiming means to direct the otherwise invisible infrared laser beam used for transmission. Techniques used with audio information transmission to address the problem of blockage by allowing the optical signal to scatter from surfaces in the environment and arrive at the receiver via multiple paths which are not blocked cannot be used for video/graphics transmission. This is because the arrival of the part of the
10 original signal which follows multiple paths are delayed relative to that part which travels directly between transmitter and receiver by about one nano-second per foot English measure of path length difference, leading to "smearing" of the data pulses far beyond their original pulse width of 1-10 nano-seconds.

SUMMARY OF THE INVENTION

15 The present invention alleviates the problem of beam blockage by using multiple beams transmitting to their respective receivers, each carrying the same signal and which are physically separated by enough distance that the probability of all beams being blocked simultaneously is very small. As an extension of this concept, this invention could also be realized by coalescing multiple beams into a single beam and multiple receive apertures
20 into a single receiver where at least one dimension is large enough that complete beam blockage is unlikely.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating embodiments of the invention, are
25 given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given in the illustration below only, and thus are not limitative of the present invention, and wherein:

5 Fig. 1 is the System Block Diagram showing associated components required for the invention;

Fig. 2 is the first embodiment illustrating the elements of the multiple beam realization of the invention and illustrating their relationship to each other;

10 Fig. 3 is the second embodiment illustrating the elements of an alternate multiple receiver realization of the invention; and

Fig. 4 is the third embodiment illustrating the elements of the large single beam and receiver realization of the invention.

DETAILED DESCRIPTION OF THE INVENTION

15 Refer to Fig 1 first for describing the system. Multiple signal sources to be transmitted to the display unit 800, such as signals from video cameras 910, set-top boxes 920, DVD players 930, TV tuners 940, video tape players 950 and the like are selected for transmission by the video-audio switch unit 300. The signals are conditioned, if necessary, by the "analog/Digital converter" 400 since the native format of optical information transmission is expected to be digital. Although analog modulation of the beam is another
20 consideration, more technical challenges occur. Signals from multiple sources are combined if desired by the multiplexer 500 which also performs data operations such as adding information for parity checking or other sorts of error checking at the receiver 200 and for "framing" the data for serial transmission. The resultant data stream is applied to the transmitter 100 which consists of one or more separate units which transmit identical data
25 as illustrated in Fig. 2. The transmitting units contain beam forming optics which may be

covered by a subsequent disclosure.

The receiver 200, which is designed to have wide receiving angle to receive high speed data, consists of one or more separate units which receive the data. Each receiver contains beam collection optics to relay the beam to the photodiode 230 as illustrated in Figure 2.

5 The resultant electrical signal from the receiver 200 is applied to the demultiplexer 600 which separates the transmitted signals from the additional information and performs other data operations, such as recovering the data clock as a timing reference for subsequent data operations, error checking and correction and converting the serial data stream to appropriately formatted parallel data. The recovered data is conditioned, if necessary, for
10 input to the display unit 800 by the digital/analog converter 700.

Refer to Fig. 2, redundant signal information 510A and 510B from multiplexer 500 is sent to a plurality of separate transmitting units 100A and 100B in the transmitter 100, which are physically separated from each other and contain beam forming optics as mentioned previously. These units 100A and 100B emit separate beams 110A and 110B
15 which are received by a plurality of separate receiving units 210A and 210B in the receiver 200 located exterior to the display unit 800. The receiving units 210A and 210B contain beam collection optics and deliver the optical signals 220A and 220B to a single photodiode 230. The optical signals 220A and 220B are then converted into electrical signals and relayed to 600 for further processing.

20 Please refer to Fig. 3 illustrating the second embodiment of the invention. The receiving units 210A, 210B containing beam collection optics and photodiodes 230A, 230B are implemented in two independent receiving units 200A, 200B. These receiving unit 200A, 200B send electrical signals 240A from photodiode 230A and 240B from the photodiode 230B representing the redundant data sent from the separate transmitting units
25 100A and 100B to the de-multiplexer 600. The de-multiplexer 600 either combines the electrical signal 240A from the receiving unit 200A and the electrical signal 240B from the receiving unit 200B into a single composite signal for further processing or selects one of

the electrical signals to be used for further processing based on some measure of signal integrity such as the number of errors or the strength of the received signal.

Fig. 4 illustrates the third embodiment of the invention, where the separate transmitters, beams and receivers are combined into one single entity. The transmitter 100 delivers the optical signals 110A, 110B, 110C in beam form which is large in at least one of its dimensions. The optical signals 110A, 110B, 110C are collected by a single large optic 210 which transmits the optical signals to a photodiode 230 and associated electronics. The obstacle 120 blocks part of the beam 110B but other parts 110A and 110C transmit successfully to the receiver 210. In order for the collected optical signal pulses to maintain their shape, the beam 110A, 110B, 110C must be of low enough divergence that all ray paths within the beam do not experience an optical path length difference from each other less than one foot. Also, the collection optics 210 must satisfy the same requirement on optical path difference from the collection point to the photodiode. If filters are implemented in the system, the distance requirement of the optical path is not necessary.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.